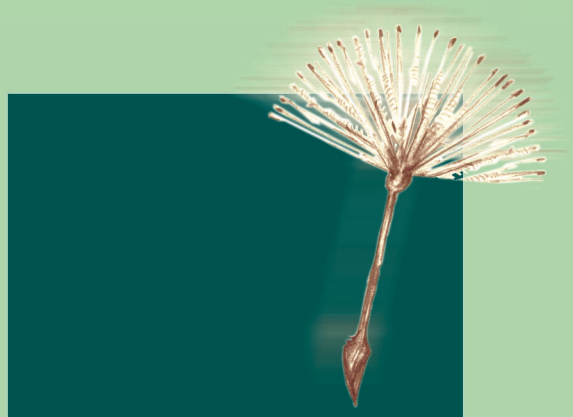
Gamtamokslinis ugdymas



2022 Vol. 19, No.1

ISSN 1648-939X / Print/
ISSN 2669-1140 / Online /

Natural Science Education

2022, Vol. 19, No. 1 **ISSN 1648-939X** /Print/
ISSN 2669-1140 /Online/

Gamtamokslinis UGDYMAS

Natural Science EDUCATION

Scientific Methodical Center „Scientia Educologica“, Lithuania,
the Associated Member of Lithuanian Scientific Society, European Society for the History of Science (ESHS) and ICASE (International Council of Associations for Science Education)

2022

This journal is indexed in a list of Science Education Journals (USA), Copernicus Index (Poland), Open Academic Journals Index (OAJI), WebQualis (QUALIS/CAPES), Academic Resource Index (Research-Bib), MIAR, EuroPub, QOAM, Crossref, ScienceGate, SCRIBD, Google Scholar, ScienceGate, Scilit, etc.

Redaktorių kolegija (*Editorial Board)*

GAMTAMOKSLINIS UGDYMAS – periodinis, recenzuojamas mokslinis metodinis žurnalas, kurį leidžia mokslinis metodinis centras „Scientia Educologica". Tai tarptautinis žurnalas, kuriame moksliniai ir metodiniai straipsniai publikuojami lietuvių ir anglų kalbomis. Leidinys skirtas mokytojams, aukštųjų mokyklų dėstytojams ir visiems, besidomintiems gamtamokslinių ugdymu.

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NATURAL SCIENCE EDUCATION – is a periodical, peer reviewed, scientific-methodical journal, issued by the SMC „Scientia Educologica". It is an international journal, wherein the scientific and methodical articles published in Lithuanian and English languages. This journal is intendent for the teachers of general education schools, the lecturers of higher educational institutions and all, who are interested in the problems of natural science education.

CGIJ OAJI: 0.201; ICDS: 3.6; Copernicus Index ICV: 100.00 (2021)

ISSN 1648-939X

Leidžiamas nuo 2004 metų du kartus per metus / Published since 2004 twice a year

TURINYS / CONTENTS

INNOVATIVE PEDAGOGY AND THE HISTORY OF EDUCATION

Boris Aberšek
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Questions about the nature of the mind and process of education originate in ancient Greek philosophers. What is the role of language? What is the relation between the structure and function in education? Are people free in their choices? Important ancient philosophers, Democritus, Plato, Aristotle and Lucretius, had tried to provide answers to these questions in different ways, while Descartes, Spinoza, Hume, Kant and many others continued where the former stopped at the end of late antiquity. Even today, in the age of technology, contemporary researchers from the fields of philosophy, cognitive science, neurobiology, and artificial intelligence ask similar, albeit technologically informed, questions. Among them are questions about the relation between human and machine or between teachers/students and learning environment and the implications they carry for solving traditional problems inside education, i.e., the problem of mental causation, or the problem of consciousness as well as various mental activities, for instance, decision-making, critical thinking and problem-solving.

Steps need to be taken towards a connection of different disciplines built around the philosophy of mind and use of innovative technologies in education, which are involved in cognitive modelling and preparing apropriatelearning environment in education. The gap between neurochemistry, cognitive science, neurobiology and other rapidly developing disciplines on one side and education as part of social sciences on the other may seem wide and even unbridgeable except by analogy, metonymy and metaphor. Yet there exist short pathways by which to travel from one to the other problem in education and back, and the study of chaos offers one such path. Brains are composed of elementary parts called neurons, and societies are made of individuals each with a brain. The organization of a brain's functions in terms of large numbers of neurons is governed by chaotic dynamics and is expressed in global state transitions, such as from sleep to waking, walking to running, breathing to speaking, teaching to learning, etc.

Teachers need to bring to attention a form of learning that transcends logic and rhetorical appeal and can be best understood as a chaotic state transition in a brain's dynamics. In order to achieve substantial changes in the process of education, such as introducing innovative strategies of learning or innovative learning environment, for example based on artificial intelligence and intelligent learning systems, the current process of education must be led to the edge of chaos where all is possible and then reformulated in terms of cognitive modelling.

Innovation, Society 5.0 and Education

From the experiences of recent decades, it seems clear that the existing educational system, as a whole, is perceived as an ailing system that fails to meet the needs of a major portion of the society it serves. If this process is to be innovated, then every aspect of it

https://doi.org/10.48127/gu-nse/22.19.04

must be studied and reconsidered in the light of new and different social expectations, for example the expectations of Industry 5.0[1] or Society 5.0[2]. The appropriate architecture needs to be defined on the basis of cognitive science and methods of artificial intelligence, while taking into account that a school system is a dynamical system which follows the dynamical systems theory. The adequate innovative learning environment includes a cognitive model that adopts both, information-processing and the human mind's structure, and one needs to consider how to build an intelligent tutoring system and appropriate learning environment (a virtual teacher) and/or intelligent teaching/learning based upon such a system (Aberšek, Borstner, Bregant, 2014).

One of the problems of contemporary society is that the educational system must be able to train youths for life, equipping them with not only knowledge and different skills, but in particular teaching them how to confront everyday challenges and problems, and in turn, how to resolve them. Young people have to develop their cognitive competences, but also cooperativeness and social competences, since these are one of the basic conditions for life-long learning and improved employability. In order to achieve this, flexible forms of learning have to be implemented (Aberšek, 2018).

The characteristics of today's generations, defined from different perspectives (sociological, technological, psychological, philosophical), and their expectations, are a new challenge for modern-day schools. The educational process should be more closely related to the individual's needs, their personal development and the cultural environment in which they live. The complexity of all the things affecting the youth of today (the environment, technology, a large amount of immediately accessible information, the possibility of direct communication with the entire world, newest insights from the fields of cognitive and neuroscience, AI, etc.) requires a well thought-out and quicker response on behalf of the creators of school policies than it did in the past, mainly because the social environment in which we live (society, technology, etc.) is changing very rapidly, and because the school of today must prepare students for occupations and social environments, which at this moment don't even exist yet. All these changes in the social environment in turn require different, innovative ways of learning and teaching, to which the entire school system must be able to adapt on a paradigmatic level. Such great changes cannot be achieved by taking small steps.

Summing-up

In the innovative learning and teaching strategy, special attention should be given also to increasing the level of interest and motivation in youth. Research shows that students who are exposed to innovative didactic and innovative learning environment, express a less depreciative attitude towards school (Flogie & Aberšek, 2017). Social interaction is integral to the healthy psychosocial development of adolescents. *Because healthy development during adolescence is complex and fraught with both challenges and opportunities, both parents and schools may need to conscientiously educate adolescents about the potential risks the problematic or maladaptive engagement with specific ICT tools or applications can bring about in their lives.* (Shaljan & Myint, 2017). The use of

1 Industry 5.0 provides a vison of industry that aims beyond efficiency and productivity as the sole goals and reinforces the role and the contribution of industry to society.

2 Society 5.0 is a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space.

modern technologies by youths in the context of social competence should be given special attention because it plays an important role in the process of socialization.

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Received 12 September 2022; Accepted 29 September 2022

Cite as: Aberšek, B. (2022). Innovative pedagogy and the history of education. *Gamtamokslinis ugdymas / Natural Science Education, 19*(1), 4-6. https://doi.org/10.48127/gu-nse/22.19.04

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USING FINE ART TO TEACH PROGRAMMING

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Abstract

When people enter the gallery of contemporary art, they are met with interactive projections which fill up the room, react to the observer and take them on new adventures. Programmers, animators, architects, musicians, draftsmen, graphic artists, and engineers participate in this kind of works of art as co-creators of the work. The classic notion that an artist is someone who can draw or paint beautiful is misguided in modern art. Today the so-called artists are people who use all their knowledge and skills at their disposal to convey their message or view of the world.
Art has always reflected the time in which it was created. So how do we include content in art lessons that require students to develop competencies they will need in the 21st century?
Animated film as a style of artistic expression is not exactly modern but is something new in the curriculum of fine arts. I tried different techniques and procedures to teach students the concepts of creating animations. From drawn animation, stop-motion animation to computer animation. The latter has many production methods and procedures, but I think combining animation and programming the students can achieve many goals and competencies necessary for their future lives or careers. The student has to understand how the animation is created, and plan how to implement the programming code to display their wishes. Programming develops logical thinking, which allows children to break down complex problems into smaller and more manageable ones which are easier to solve.
My goal for the students is they learn to use construction knowledge, collaboration, communication, and ICT in art classes and additionally learn how to program.
Keywords: *computer animation, interactive projections, visual art, Scratch*

Introduction

Fine art is a form of storytelling through visual communication. Its purpose is to convey a clear message about inner experience and to create through various techniques and media. Animation is an excellent medium for artistic expression, as it connects various art techniques with other artistic fields such as music and language. Thus, different ways of communication are combined and connected in the illusion of movement.

The manual for the animated film Let's Animate, quotes: "For animated films can be said to accompany us throughout our lives. They are an important mass medium and a versatile means of artistic expression."

In art classes, we use animated films both as a didactic tool and as an artistic product. For students, the combination of technology and self-expression through visual communication is interesting and fun. "In today's world, the use of technology is required and expected in every profession or workplace and is an integral part of everyday life. Information technology enables and supports different approaches to teaching and learning. Technology enables rapid feedback. Technology should not diminish the role of the teacher and students in artistic expression." (Curriculum, 2011). By using digital technology in art classes, we enable students to learn new ways of expression, creation, and visual storytelling.

https://doi.org/10.48127/gu-nse/22.19.07

ISSN 1648-939X /Print/, ISSN 2669-1140 /Online/

I myself started introducing animation as a medium into my teaching work in 2010 as an attempt to enrich the leisure time of primary school students during their extended stay. With a laptop, a camera and a simple stop-motion animation program, I learned together with the students about the expressive possibilities offered by the medium and the software. The students were already impressed by the fact that they could animate toys, cars, and legos with a few clicks. In doing so, I also encouraged them and taught them how to create and convey a story or message in a visually interesting way that will be understandable to everyone, not just the creator of the animation. I quickly realized that making animations is relatively easy for students. What presents them with a significantly greater challenge is how to convey a clear and comprehensible message through the medium of animation. This is precisely why this type of creation holistically enables the development of all areas of the students' personal development.

"The basis for animation is always a story. We need to know exactly what we want to deliver with it. As with a film or a video, we need to break down the story into smaller parts, sequences, dynamic framing, which in sequence clearly express our thought. The space of the cartoon is the space of our imagination. That's why the most incredible things can happen in cartoons (hands grow, bodies fall apart and reassemble, submarines fly)." (i-textbook for Fine Arts in high schools)

"A picture is worth a thousand words." However, the problem that my students most often face is how to convey just one message with a picture that is comprehensible to others. I have found that it is much easier to convey a message through words than through a picture. Thus, through practice, I developed and learned different didactic approaches, how to effectively lead students to an integrated product. In the process of research, the question also arose, which animation technique is the most suitable for the purpose of the lesson. The concept of creating an animation is relatively simple, but there are many techniques for creating it (stop-motion, pixelation, computer animation ...). Therefore, it is necessary to consider which of them are appropriate or meaningful for the purpose of the lesson, the age of the students, the school's technical equipment, etc. In this process, I discovered the Scratch tool, which in the creative process of making animation also enables learning the basics of programming.

Pedagogical Application

What is Scratch?

Scratch is a visual programming language that is widely used by children all over the world. This colorful and dynamic language consists of blocks and allows the user to create web projects, games, animations, and many other things. It is designed to teach programming and programming concepts for building a code by using simple commands. The purpose of the program is to learn how to make the program do what we want it to do. We build the commands as a chain, one after the other. With this program, we tell it what it has to do, when and in what sequence.

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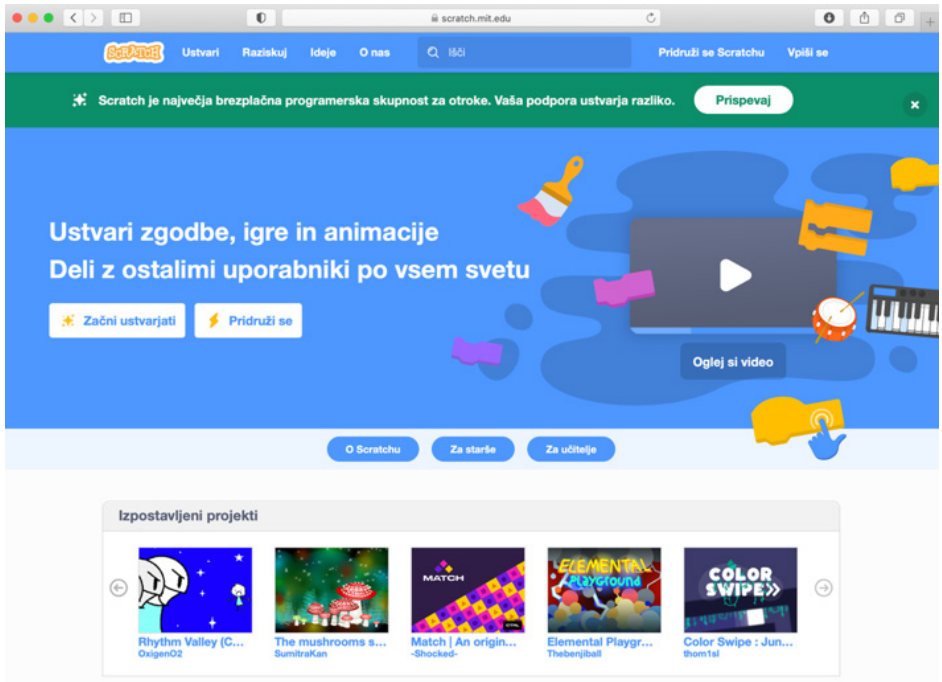
Figure 1
The Introductory Page of the Scratch Website



On the website https://scratch.mit.edu or in the Scrath Junior application, students tried their hand at making animations. First, they were able to master simple block programming procedures through tutorials. They animated digital figures, taught them to dance, fly, talk ... Then they learned to program various figures to react to each other. In doing so, they were able to manipulate the background of the animation so that it changed. The students learned through the process of tutorials, in which they follow pre-prepared videos that clearly showed them which commands they needed to put together block by block in order for the program to do what they wanted. Since the videos are clear and the program works in many languages, the students quickly mastered these basics.

Figure 2
Tutorials on the Website

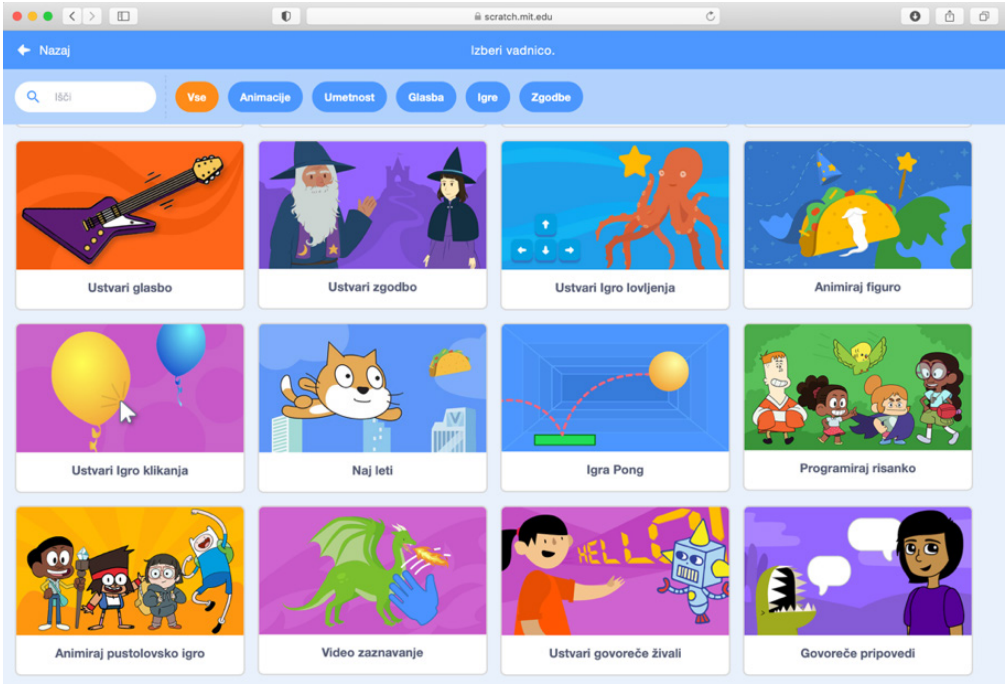
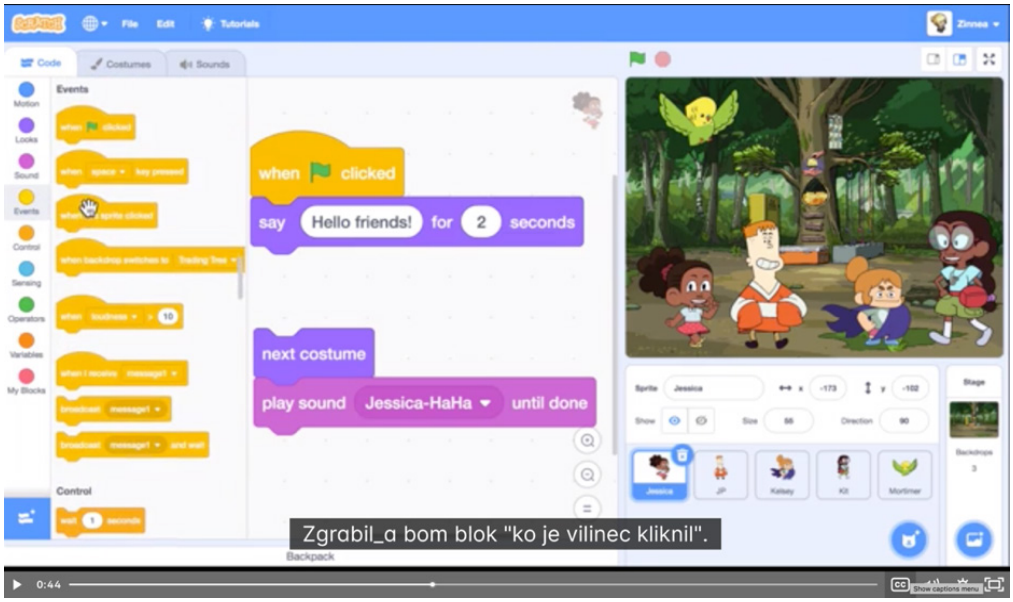


Figure 3
Tutorial Program a Cartoon



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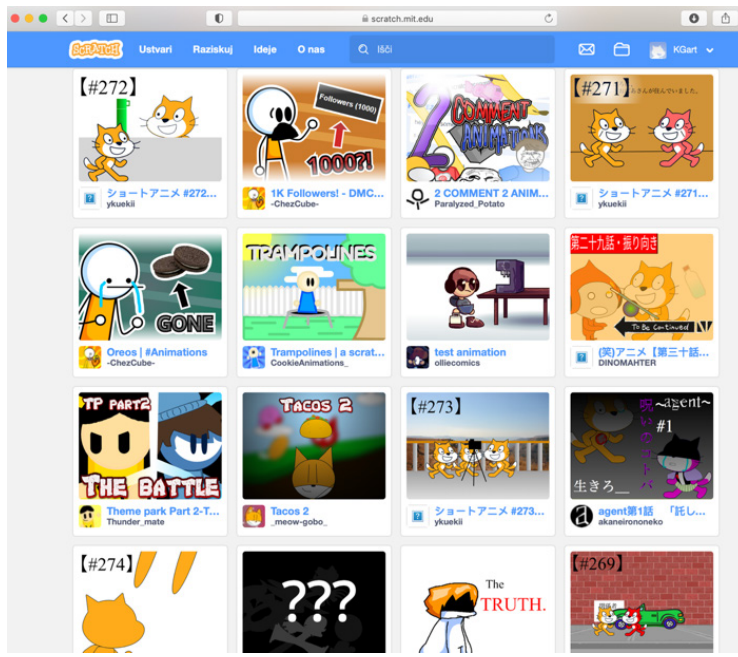
The tutorials proved to be an excellent didactic tool, as each student could stop the recording and thus repeat the procedures more easily. They could play the same recording several times and thus created their own version of task. Students were able to work at their own pace continuously and without waiting unnecessarily for others, which is usually typical for this type of learning.

Once the students had mastered the basics, they started their art assignment. Make your own animated film with a clear message. It should involve several characters who will talk and respond to each other. The scene should change at least once, and the story should have a clear conclusion.

For motivation, the students previously viewed the works of other authors, where they could also see their programming codes. The purpose of the assignment was to learn through research and collaboration. They mastered the programming language and at the same time learned the rules of the visual language. They had to use art elements such as composition, color theory, framing ... The advantage of such tasks is that students learn how to use their knowledge of fine art in other forms of expression.

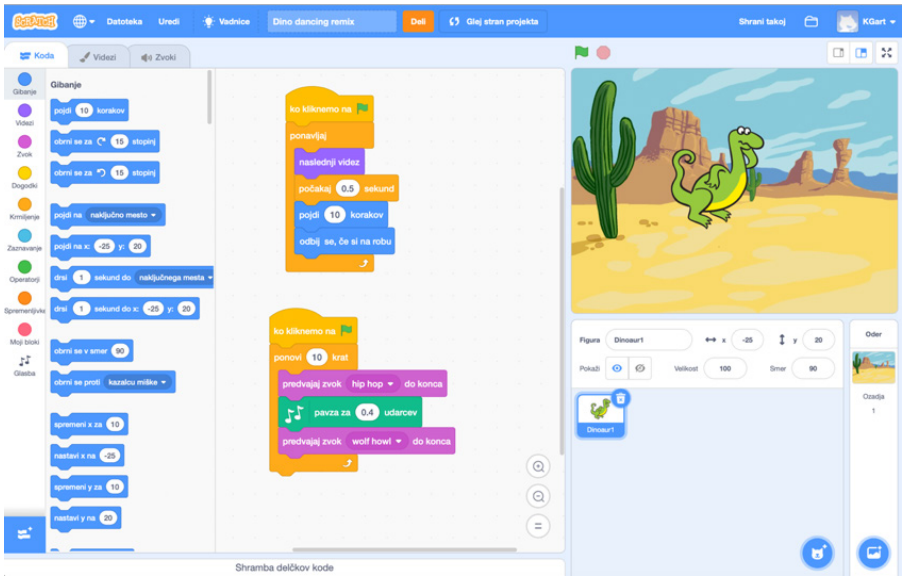
Figure 4

A Collection of Animations by Other Creators



I conducted the art assignment, both in different age groups of students, as well as in the form of remote learning. I was satisfied with the results. In the process of creating visual communication, the students mastered the concept of animation, the concept of programming and the importance of telling an understandable story. Learning by exploring what others have already created is faster and the students have analyzed the code and explored the causal sequences of the code. In doing so, they learned what happens if one part of the code is changed or removed and how it affects the course of the animation.

Figure 5
Animation View and Animation Programming Code



Shramba delčkov kode

I also repeated the task with younger students at the optional subject of the grade level. In doing so, we used a simpler version of the program in the form of Scratch Junior application on tablets. Here, the commands are simpler and more clearly displayed as pictures. Students just put the pictures in a sequence like a train, and as a result they quickly learn the sequence of events. Animations are simpler, but they still allow students a lot of expressive possibilities.

Figure 6
Scratch Junior Application

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Conclusions

Programming is an activity that every child should learn as independently as possible. Through the creation of such learning opportunities, we can place students in the active role of creators and thus at the center of their own learning process. With meaningful and effective use of technology, the teacher takes on the role of organizer and mentor, leaving learning and creation to the students. Writing code is a big step up from learning the basic concept of animation. Through simple visual commands, children learn the basics needed to understand programming. Students learn from their own mistakes, through exploring and playing. This is only the first step on the way to becoming a real programmer or animator, but every journey begins with the first step.

When we think of fine art, most people think of its classic art fields: painting, drawing, sculpture, graphics ... It is less known that students can learn the basics of programming in fine art classes. I personally think that this kind of multidisciplinary knowledge, which encourages a divergent way of thinking, is one of the main competencies that students need today for a creative and quality life in the future.

When students watch cartoons on TV or play video games on various devices and consoles, they don't see the graphic designers, visual programmers, animators, and other artists who create them. Through these kinds of tasks, I try to bring them closer to the idea that knowledge is universal and applicable everywhere. Thus, they can transfer and use the knowledge they acquire in my art classes almost anywhere.

Through the presented learning process, students learned to use construction knowledge. During programming, they learned how to use a computer gadget to perform the operations they wanted. While learning, they had to research the instructions in the video tutorials, help each other and analyze the codes of others who have already succeeded. In doing so, they had to create a clear and comprehensible message in a visual form, using the requirements of art theory and artistic concepts. This kind of holistic knowledge and competences are invaluable in today's world.

Why fine arts and programming? My answer is that creativity manifests and expresses itself in many individual ways that are unique to individuals. Developing long-term competences such as holistic and critical thinking, problem solving, cooperation and creativity, which are supported by digital literacy, are the so-called competences of the 21st century. This is what the students will need, regardless of their further life path, either as users of contemporary art or as potential future artists.

Acknowledgement

The author gratefully wish to make acknowledgement to the Project No.: C3330-17-319016; Innovative learning environment supported by ICT – Innovative pedagogy 1:1 for financial support. The project is co-financed by the Republic of Slovenia and the European Union from the European Social Fund.

Note

This is a revised and expanded version of the 5th International Scientific Conference on *Philosophy of Mind and Cognitive Modelling in Education* paper in *Gamtamokslinis ugdymas / Natural Science Education*. The paper was recommended for republication by the conference scientific committee. Available: https://pce-fnm.si/conference-proceedings

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Received 25 September 2022; Accepted 05 October 2022

Cite as: Gajšek, K. (2022). Using fine art to teach programming. *Gamtamokslinis ugdymas / Natural Science Education, 19*(1), 7-14. https://doi.org/10.48127/gu-nse/22.19.07

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ENCOURAGING THE USE OF LANGUAGE LEARNING TOOLS WHEN TEACHING SLOVENE AS A SECOND/FOREIGN LANGUAGE

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Abstract

Each year, more students, who do not speak Slovene as a first language, are enrolling in schools in Slovenia. Some encounter Slovene for the first time, others already know the basics and are looking to build upon their knowledge. Knowledge starting points are determined with standardized testing. Educators then base courses on the results of these tests. After successfully completing the language course, students achieve the A2 language proficiency level, which is not yet sufficient for successful class participation, so additional work is recommended. In the submission I explain, how we can make traditional lessons more engaging. We can achieve this by including language learning tools such as dictionaries, lexicons, audio databases etc. The use of these tools in the classroom, I believe, should be mandatory, as digitalization is irrevocably changing the nature of our work. In the time of e-learning, every teacher had to adapt to the use of online tools. The opportunities for additional education were many, and veritable learning communities formed. One of these opportunities is the project Inovativna pedagogika 1:1.
By including foreign language students in regular classes everybody stands to gain something. It is an opportunity to encounter different cultures, build a culture of dialogue and break taboos. Many have learned that similar problems can have many causes, and that every individual needs opportunities for education and development.
Keywords: *innovative education, foreign language, Slovene as a second/foreign language, language learning tools*

Introduction

At the beginning of each academic year, our school organizes an intensive Slovene language course for students, who did not submit a certificate of A2 level language proficiency in Slovene. Groups of 4 to 6 students take 120 hours of classes, groups of 7 to 12, 160 hours, and for groups larger than 12 students, an additional 15 class hours are added per each student above 12. The course takes place in a condensed form in the first half of the school year, as prescribed by the *Rules on Slovenian language courses for secondary school students*, taking into account the students' normal weekly course load. Ideally, the course would take place before school starts for the year.

The course is very intensive, I've been thinking of the ways students could be prepared for further, independent work, so they could progress without the assistance of a teacher. To achieve this, I've started to include information technology practices, which did not pose significant problems, as most students already know how to search for information using smartphones, tablets, and laptops, and are accustomed to the digital environment. We've also created an online classroom, which enabled individual work. The students were highly motivated because they knew they required this knowledge to participate in their regular classes.

https://doi.org/10.48127/gu-nse/22.19.15

ISSN 1648-939X /Print/, ISSN 2669-1140 /Online/

Beginnings

We begin by introducing the participants in the course.

Example: Ime mi je Sajjad, prihajam iz Irana, obiskujem Srednjo strojno šolo. (My name is Sayyad, I come from Iran, I attend the Secondary Engineering School.)

In these introductions, we encounter nouns in the masculine, feminine and neuter genders, and the 1st, 2nd, and 4th cases. When grouping words, we can see that feminine nouns generally end with the -a suffix, neuter nouns with the -o/-e suffixes and masculine nouns with the – Ø suffix. To make these tasks easier, we can look up charts in the textbook we use, or we can use an online dictionary (https://fran.si/). We look at a few examples of dictionary entries and discover what we can learn from them. In addition to this, we can also look up how individual nouns are declined (https://besana.amebis.si/pregibanje/ or https://www.xn--franek-l2a.si/beseda/s024584/jezik).

Figure 1

Franček, Language Portal – Declension

Let's also examine verb conjugation. In Fran, the online dictionary, we look up the entries for the verbs prihajati (to come, 1st person suffix -am), stanovati (to inhabit, 1st person suffix -ujem), obiskovati (to attend, 1st person suffix -ujem), pisati (to write, 1st person suffix -em), brati (to read, 1st person suffix -em) … We can look into special cases later. If we put enough time and effort into these introductions and teaching the use of language tools, the students progress at a faster rate, which is why we encourage the didactic use of information technology tools. Using the SAMR model for the identification of the level of IT integration in the pedagogical process, this part of the class would fit in the augmentation category, as traditional learning tools are made more effective with IT.

As the Slovene language course is taking place, the participating students are also attending their regular classes. In those, they come across new words and complicated sentence structures. Using internet tools, we can look up into which field of study the

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words they learn fit, and how often they appear in different types of texts. We can find this out using corpora, electronic collections of texts.

Theoretical Groundwork – Language Varieties and Levels of Analysis

At school, students encounter different varieties of the Slovene language. Classes, and communication with teachers, are conducted in formal, elevated language, practical classes often include jargon, and regular conversations include slang, local varieties of the language and regional accents.

Language Varieties

a) Social varieties (register)

Students are taught formal, elevated Slovene, we also pay attention to examining differences between standard and elevated formal Slovene. Beginners tend not to have problems with the use of standard Slovene, as they aren't familiar with any different varieties. More effort is required when teaching students who already know a local variety of Slovene, as they often need to be corrected when their use of the language differs from the rules of standard Slovene.

b) Varieties differing by function

The focus of the course is teaching the kind of language that is used for general communication. In addition to texts which show examples of regular, everyday communication, the textbooks include examples of language used in publishing (news, reports on current events, and later even articles.) The publication Ljubljana (https://www.ljubljana.si/sl/mestna-obcina/publikacije-mol/) provides many interesting texts, usually articles about actors, athletes, scientists, natural landmarks and cultural goings-on. Learning about more literary and artistic language use is only possible with students who already know the basics of Slovene, as the texts are much more complex.

c) Varieties differing by medium

Students must learn both speaking and writing in Slovene. The classes put more focus on spoken language, students mostly learn written language by doing homework. As the course is completed, the students take the A2 level language use test, which is why they need to be able to form their own written texts in Slovene. This is, of course, only the beginning. As they continue their education, writing more difficult texts will be required of them – essays, resumes, complaints, commendations, requests… In addition to this, they will also regularly encounter written exams in their other classes.

d) Varieties differing in time

Beginner students are only taught the modern, standard Slovene language. They will encounter older varieties of the language when reading certain texts in their regular classes. We teach the oldest Slovene texts in the 1st year, 19th-century texts in the 2nd year, and in the 3rd and 4th years, texts from the 20th century and later.

ISSN 1648-939X /Print/, ISSN 2669-1140 /Online/

e) Varieties differing in structure

In classes we generally interact with prose, but we sometimes include the language of poetry, to make classes more engaging - we encounter texts with rhythm and rhyme, folk songs, and lyrics to songs the students know. When we learn the language, we're also learning about Slovene history and culture.

Levels of Language Analysis

a) Pragmatic

When teaching beginners, we begin with the Slovene alphabet, and learning about grammatical rules as they come up. With students, who already know some Slovene, we systematically try to correct the grammatical errors they make. These errors are often dependent on the first language of the student, so individual work is required, as no two students will make the same errors. We also encounter students who are not used to the Latin alphabet.

b) Phonetic

Students, especially beginners, are introduced to the phonemes of the Slovene language, the relationship between letters and sounds (graphemes - phonemes), the system of Slovene vowels and consonants, and stressed and unstressed syllables. Paying attention to this from the beginning makes further work much easier, as there are fewer mistakes to correct. It is wise to offer students additional class time for phonetics.

c) Morphological

Slovene is an inflectional language. At the beginning, we determine word gender by looking at word suffixes. When teaching this we also teach how to use dictionaries and other language tools. We also teach the functions of the different noun cases.

When the motivation for learning falters, because there is so much to memorize, we can look up examples of how foreigners learn Slovene. Linguists, scientists, actors, and others explain how unusual they found noun declensions, list words that they found especially difficult or funny. One of these videos is included with the workbook Na pragu besedila 2 (Martina Križaj … [et al.], Rokus Klett, 2018). Chikako Shigemori Bučar, a Japanese lecturer at the Department of Asian Studies at the University of Ljubljana Faculty of Arts talks about (https://folio.rokus-klett.si/?credit=NPB2DZ&pages=12-13) the process of learning Slovene, which she needed for her work at the university. She was surprised by noun declensions, which aren't found in English or Japanese, where nouns keep the same form regardless of context. Klaus Detlef Olof, a German poet and translator talks (https://folio.rokus-klett.si/?credit=NPB2DZ&pages=12-13) about how he spent years learning different Slavic languages, and how this made learning Slovene harder, as many words are similar or even the same, but have a completely different meaning. When he finds himself in the company of speakers of various Slavic languages (Slovene, Croatian, Serbian) he encounters many similarities between the languages that actually make it more difficult to understand each other. Jette Ostan Vejrup, a theatre performer from Denmark, stresses

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(https://folio.rokus-klett.si/?credit=NPB2UC&pages=4-5) how much time and effort she put into learning certain sounds, like s, c, z and š, č, ž, as her profession requires perfect pronunciation.

All in all, the Slovene language has to be taught systematically.

d) Semantic

Beginners learn basic vocabulary (greetings, professions, nationalities, food and drink, stores, days, months, seasons, clothes, traffic, weather, family relations, school, friends, free time etc.) and in doing so learn compound words (diminutives, stylistically marked words). Students, who already know some Slovene, encounter set phrases and idioms, which are some of the hardest to learn parts of a foreign language.

e) Syntactic

Nominal phrases with premodifiers that match the noun in number, declension and gender generally pose no problems. Nominal phrases with premodifiers that determine quantity tend to be more difficult. Word order can also pose complications.

Two Examples of Good Practice, From the Time of Remote Learning

a) Introducing or describing a person

When learning a language, we also follow current events, politics, culture. In the middle of March 2020 standard classes were replaced with remote learning. We quickly got used to learning in this way, but still desired the closeness that comes with in-class work. We anxiously awaited new reports from the experts, and the day we would finally return to school seemed further away each week. During this time the doctor, immunologist, professor, writer and poet, Dr. Alojz Ihan made regular appearances on the daily news. In the publication from the City of Ljubljana, also accessible online, appeared an interesting article about him, titled: *Ljubljančan: dr. Alojz Ihan, Ljubljana ima na videz vse, kar si človek od zdravstva lahko želi* [Citizen of Ljubljana: dr. Alojz Ihan, Ljubljana seemingly has everything one could want from healthcare] (https://www.ljubljana.si/sl/mestna-obcina/mestna-uprava-mu-mol/oddelki/oddelek-za-zdravje-in-socialno-varstvo/koronavirus-informacije-in-ukrepi/ljubljana-ima-na-videz-vse-kar-si-clovek-lahko-od-zdravstva-zeli/).

Students will encounter Alojz Ihan in their 4th year, when learning about modern Slovene literature. They will learn about him as a poet and essayist, some may even go on to become his students after they graduate. An article like this can be used for many different activities, such as writing a text describing a person.

After reading and talking about what was read, we write down basic facts – profession, family, interests, a description of the regular workday. We learn new vocabulary and set phrases, and because of the time the article was published, we also learn about the virus, methods of protection from it and differences in people's habits. At this point the students can talk about their own experiences, form short texts, dialogs, interviews, descriptions of people that had an impact on them.

b) Terms regarding quantity, describing a process

I've mentioned that nominal phrases in which premodifiers use terms regarding quantity tend to be more difficult to learn. Why? Because they require the use of the 2nd case, and knowledge whether the premodifier is a countable or an uncountable noun. An excellent way to cover this is to use a cooking recipe. Because the year 2019 was the 200th anniversary of the death of Valentin Vodnik, we decided to use one of his recipes. *Vodnik's or "repuncle" salad,* which was published in the publication Ljubljana (number 3, 2020, Mestni svet občine Ljubljana, also accessible at https://gourmet-lj.si/si/aktualno/recept-vodnikova-ali-repunclova-solata). The original text from 1799 is also available (https://www.dlib.si/details/URN:NBN:SI:DOC-MKZZ31GS).

Vodnik only lists the ingredients, there are no quantities listed. Students are asked to write down recipes of their traditional dishes and present them to the class. In this way, we don't only learn terms regarding quantity (liter, kilogram, a little, a lot, some, pinch, piece, spoonful, packet, cupful, a loaf, a glass, a handful) but also about their culture and home. We list nouns in the 2nd case (Koliko ČESA – how much *of what*?) and nouns in the 4th case (potrebujem KAJ – I need *what?*).

We write down the nouns in the 2nd case (how much *of what*?) and nouns in the 4th case (*I need what?)* and separate the nouns into countable and uncountable ones.

Example:

How many + 2nd case plural: apples, pears, lemons, oranges, cherries, peaches, cucumbers, courgettes…

How much + 2nd case singular: fruit, pineapple, salad, parsley, ice cream, bread, cheese…

Conclusions

Learning about foreign languages and cultures enriches us. When seeing the progress of students learning Slovene for the first time, other students get a different outlook on language learning. Teaching Slovene as a second language is very different than teaching it as a first. The education required is provided by the Center for Slovene as a second and foreign language, which works as part of the Department of Slovene Studies at the University of Ljubljana Faculty of Arts. They have published many textbooks, manuals, online resources, and in addition facilitate the tests that determine the language knowledge level when learning Slovene. The program *Slovene for children and teenagers* is intended for children, teenagers, and their teachers. In the courses for our students, we use the *Čas za slovenščino 1* and *Čas za slovenščino 2* (*Time for Slovene 1* and *Time for Slovene 2*). We also must keep in mind that students aren't only learning during the course, but also in their regular classes and when socializing with their classmates and interacting with their environment.

Did we measure anything? At the end of the course the students took the A2 level Slovene language test. The exam consists of a written and an oral part. In the written part, vocabulary, grammar, style, form, and content are assessed. In the oral part, vocabulary, grammar, content, pronunciation, and the use of the correct functional variety are assessed. For the A2 level, in order to pass, the student must reach a minimum score of 60%, the final grade is descriptive, not numerical.

 https://doi.org/10.48127/gu-nse/22.19.15

Acknowledgement

The author gratefully wishes to make acknowledgement to Project No.: C3330-17-319016; Innovative learning environment supported by ICT – Innovative pedagogy 1:1 for financial support. The project is co-financed by the Republic of Slovenia and the European Union from the European Social Fund.

Note

This is a revised and expanded version of the 5th International Scientific Conference on *Philosophy of Mind and Cognitive Modelling in Education* paper in *Gamtamokslinis ugdymas / Natural Science Education*. The paper was recommended for republication by the conference scientific committee. Available: https://pce-fnm.si/conference-proceedings

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Received 10 September 2022; Accepted 06 October 2022

Cite as: Kajič Kmetič, Š. (2022). Encouraging the use of language learning tools when teaching Slovene as a second/foreign language. *Gamtamokslinis ugdymas / Natural Science Education, 19*(1), 15-21. https://doi.org/10.48127/gu-nse/22.19.15

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UPGRADING SCIENCE WITH ENGLISH AND ICT

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Abstract

The 21st century brought many changes to the Slovenian school system. The idea of teaching using more modern, active methods and forms of learning and teaching where the student follows the idea "What I hear, I forget. What I see, I remember. What I do, I understand!" was necessary. Information and communication technology development enabled all participants in learning and teaching to look outside the box and beyond the horizon. It enabled students to be more involved in the pedagogical process and encouraged their activity. The Covid-19 pandemic literally overnight changed the learning and teaching process. The students were confused and scared, and the teachers faced the professional challenge and the desire to motivate their students and reach their educational goals. Using online applications (Liveworksheets, Edpuzzle, WordItOut, Wordwall), developing reading comprehension, formative assessment, flipped learning, making videos, and multilingual teaching in combination with classic methods is a successful example of a months-long cross-curricular integration of science and English. The evaluation of the work and the students' reflection showed how vital good lesson planning is, as well as the fluidity and almost imperceptible intertwining of the two subject areas (Chemistry-English and Biology-English). Immediate feedback helped to reach the learning goals faster and better. Multilingualism is an essential step toward the school of the future. The quality of the acquired knowledge and skills was visible in the final report - the student's grades.

Keywords: *cross-curricular integration, ICT, online applications, science teaching*

Introduction

The Covid-19 pandemic has brought significant changes to Slovenian education. Overnight, we needed to adapt to conditions we had not been prepared for - remote work. We focused all our energy on preparing customized lessons, which undoubtedly presented a big challenge. The established methods and forms of learning and teaching suddenly became unsuitable for working remotely. On the other hand, the students felt confused and scared. The formation of online classrooms reconnected teachers and students, and video conferences became the new "live" classes. Due to the absence of direct contact with students and the difficulty of obtaining feedback, the biggest challenge was to make the lessons enjoyable, motivating, active, and thriving. Active learning and teaching methods, online apps, and multilingualism have proven successful when working remotely and in the classroom.

Chemistry and English

The primary school chemistry curriculum divides chemistry content into units. The chemistry curriculum is designed to realize fundamental competencies (abilities) for lifelong learning, defined as a combination of knowledge, skills, and attitudes. Priority in chemistry is given to developing mathematical competence, fundamental competencies in natural sciences, and digital literacy. At the same time, the chemistry curriculum enables the implementation of many components of other vital competences for lifelong learning:

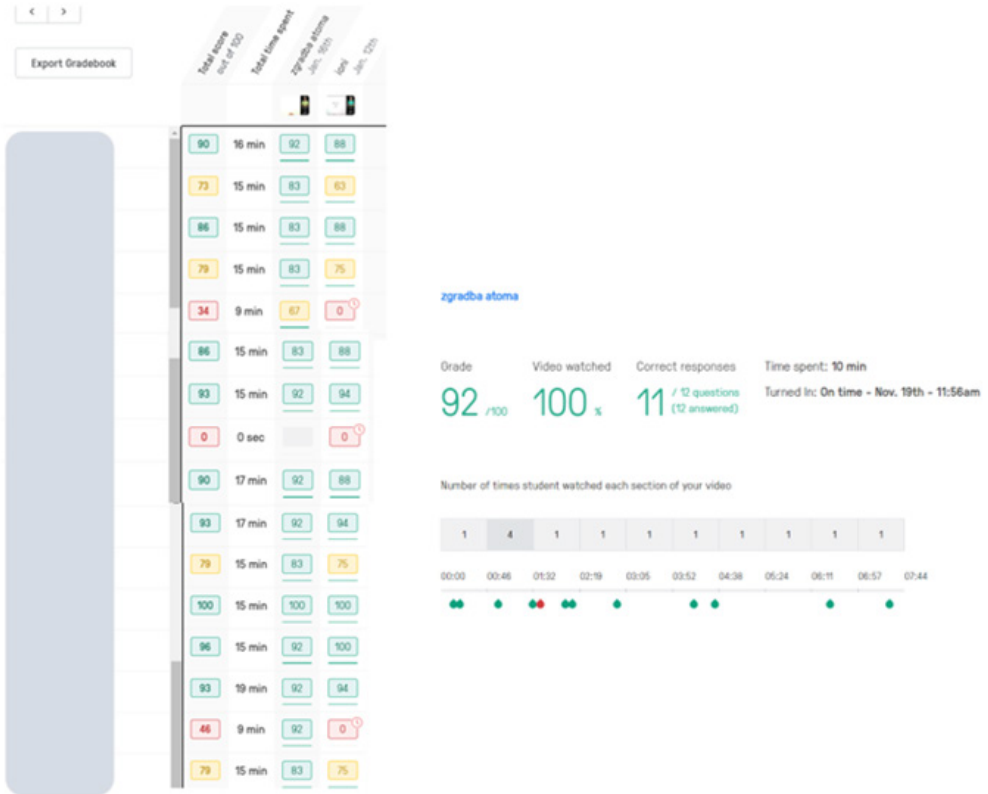
https://doi.org/10.48127/gu-nse/22.19.22

communication in the mother tongue (the ability to express and understand concepts, facts, thoughts, emotions and opinions in written and oral form; creating and expressing one's oral and written arguments in a persuasive manner appropriate to the circumstances), communication in foreign languages (understanding the most basic chemical terminology in a foreign language for using resources in book and electronic form), learning to learn (planning one's own activities, responsibility for one's own knowledge, independent learning, developing metacognitive skills, work habits), social and civic competences (constructive communication when participating in a group; responsible attitude towards arranged tasks and obligations), self-initiative and entrepreneurship (creativity, taking initiatives, planning, organizing, leading, risk assessment, decision-making) (Učni načrt. Program osnovna šola. Kemija, 2011).

The initial idea was that the students would reach some of the goals of the unit Atom and the structure of the atom with the help of a video explanation. I found a content-appropriate video on the Internet, but it was in English. I forwarded the video to an eight grade English teacher and asked for an expert opinion on the appropriateness of the video. It was a spontaneous beginning of the cross-curricular integration of science and English. Using different forms and methods, I taught the unit on atoms, and students completed various tasks to gain knowledge of the unit. The purpose of the video was to consolidate the acquired knowledge. In the English lesson, students watched the video and acquired the vocabulary. To consolidate their knowledge in chemistry, the students used the Edpuzzle application, where they solved the tasks based on the video.

The application serves as a tool to prepare an interactive video by adding comments and questions to the video, which the students can answer. Student responses are recorded and can help the teacher monitor progress and understanding. The teacher can monitor the results of individual students and obtain information on the difficulty of the tasks. It is essential feedback that allows the teacher, as well as the students, to consolidate and revise. The application is suitable for testing comprehension and theoretical content. It enables individual enrollment of students in classes and thus provides a closed group of users to protect their personal data ("Edpuzzle," 2014).

Figure 1
Students' Scores in the Edpuzzle App



The evaluation and students' self-evaluation showed that the students successfully reached the goals set in chemistry and English. The purpose of the next step was to apply the acquired knowledge on the atom. The students randomly chose their respective atoms using the online learning tool Wordwall (Random cards). The students' task was to make a model of the chosen atom.

The Wordwall app allows teachers to create interactive games and printed materials for students. There are 33 templates available, and it is possible to create activities in 41 languages. Teachers put in the content, and the rest is automated. In the past, teachers used didactic slips and post-it notes, which they stuck to the wall or blackboard and thus made lessons more active and engaging. The Wordwall app works in the same way ("Wordwall About," 2021).

When using the Wordwall app, the students are task solvers as well as task creators. They can choose different templates (Open box, Quiz, Matching, Random wheel, Missing word, Hit the mole) and create their own tasks.

As the shops were closed due to the pandemic, the students made a model of their atom from various materials they had at home. The teacher and the students determined the criteria for constructing the atom model. The most important rule was that the structure must be chemically correct (electrons, protons, neutrons, shells, electronic configuration); they could ignore the spatial relations (size).

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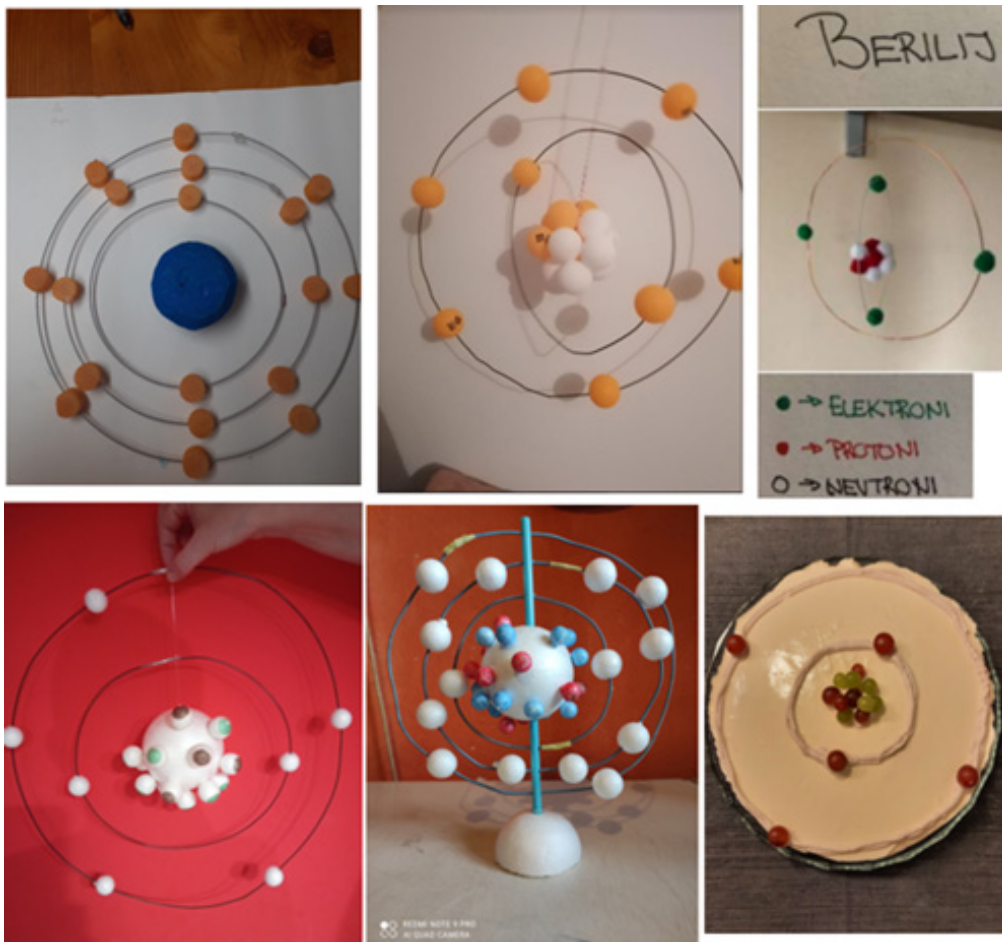
Figure 2
Students' Creations



I uploaded all the assignments and instructions to the online classroom, which gave the students constant access, and the teacher had an insight into the student's activity and engagement.

Since the result of cross-curricular integration and working with various online applications was successful, we carried out the unit on ions in a similar way. I explained the unit on ions via video conference; students worked independently using different methods. Students acquired English vocabulary with the video in English and did exercises in Liveworksheets to practice the use of the vocabulary. Students consolidated their knowledge of ions with the Edpuzzle online tool video.

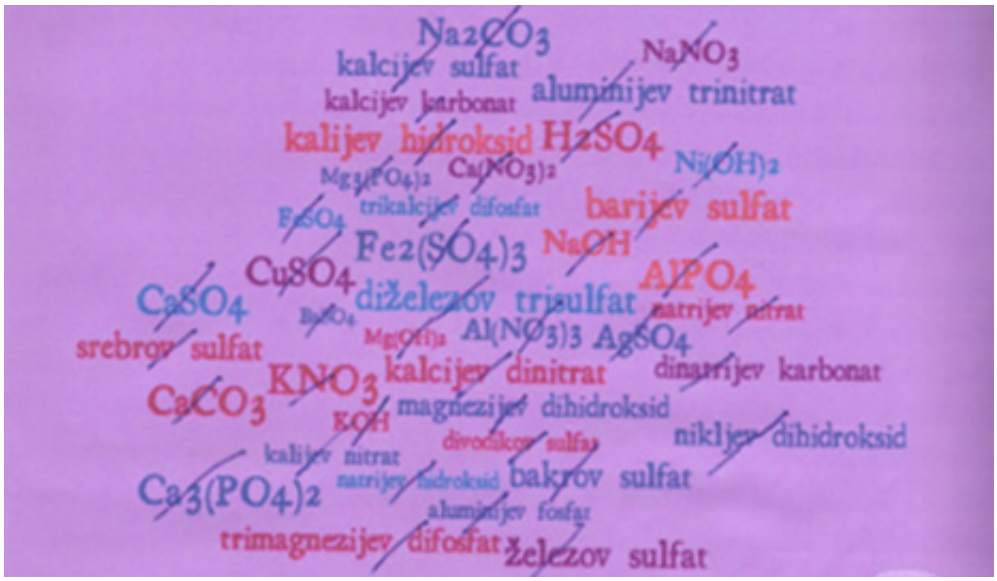
The students' feedback was positive and encouraging. In their opinion, different approaches and their own activity made distance learning enjoyable, and the acquired knowledge sustainable. An essential step towards broadening their horizon is upgrading their knowledge of chemistry with professional terminology in English.

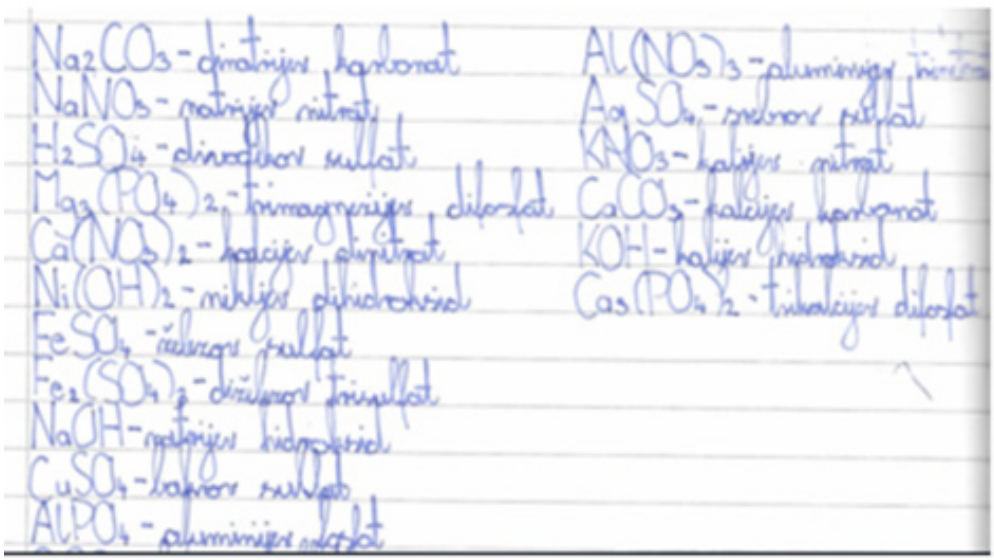
WordItOut is an application that I used to reinforce the labeling of cations, anions, and ion compounds. Students matched the formulas and labels in the word cloud and wrote down the pairs.

ISSN 1648-939X /Print/, ISSN 2669-1140 /Online/

WordItOut is a word cloud generator that enables teachers to use many custom settings. They can create word clouds from sentences, entire documents, or tables. They can decide which words to show or remove from the word cloud and thus easily adjust their importance. They can design their own word cloud, find the perfect layout, choose the colors, fonts, and sizes, or let WordItOut choose a random look. It is possible to download a copy as an image file ("WordItOut - Enjoy Word Clouds, Create Word Art & Gifts," 2022).

Figure 3
Using the WordItOut Application





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Although the application is in English, it supports Slavic letters and enables the writing of chemical formulas. The students were already proficient in working with the online tools mentioned above. The immediate feedback that these online tools provide enables all participants of the learning process to track progress and provide additional explanations or revisions. The next level of the cross-curricular integration of chemistry and English, or the upgrade, was planned based on these findings.

Flipped learning and teaching is an innovation that was created based on evaluating one's own practice among teachers and looking for ideas to improve their teaching and increase the effectiveness of students' learning. Three elements are essential for this learning to be effective: content, curiosity, and the relationship with the teacher. Flipped learning is a teaching technique with two components: interactive group activities in the classroom and computer-based individual instruction outside the classroom. The key components of successful flipped learning are collaboration, student-oriented lessons (the teacher is a mentor, encourager, and guide), optimized learning space (suitable for group and collaborative learning formats), sufficient time for implementation, teacher support, and help in preparing online material (Plešec Gasparič, 2019).

The students were divided into five heterogeneous groups of four students each. The division was well planned, both in chemistry and in English. In the English lesson, students acquired professional terminology based on the video.

In the chemistry lesson, students analyzed and synthesized the acquired knowledge on the topic. As a group, the students recorded a video in their mother tongue explaining the subject (Formulas of ionic compounds and formulas of polyatomic molecules). The teacher and the students set the general criteria for the video. However, each group freely decided how to prepare the presentation and select the examples. Students' videos were reviewed by both teachers and corrected if necessary.

Each group prepared consolidation tasks in English for the students of the other groups in the Wordwall online tool. Both teachers reviewed the tasks and corrected the mistakes before students from the other four groups did the tasks. The application gives feedback on the tasks' results and thus enables teachers' assessment and students' self-assessment.

Evaluation always follows the stages of acquisition, consolidation, and revision of knowledge. It is necessary to assess and revise prior to evaluating the students' knowledge. Assessment in descriptive evaluation is, at the same time, an evaluation, while in numerical evaluation, assessment is the justification of the evaluation. In the evaluation, we focus on identifying and evaluating the student's achievements according to the set expected and mandatory goals (Golubič, 2013).

Making a video explanation of the task "My Atom" was a method of assessing the student's knowledge. Considering the different prior knowledge of chemistry and the student's computer literacy was necessary. The teacher and the students determined and set the criteria for making a video explanation. Using the WordItOut application, the students determined keywords and formed a word cloud. Students had to use these keywords and the atom model they had made during the lockdown in their presentations. However, the students could choose the method of presentation according to their preferences (use of presentation programs, blackboard, poster, and didactic leaflets). The students also proposed and, together with the teacher, formulated the evaluation criteria, which were the basis for evaluating their individual video explanations. Before the evaluation, students watched and assessed a few randomly selected video explanations according to the set criteria. In the formative assessment, the students compared and discussed their feedback.

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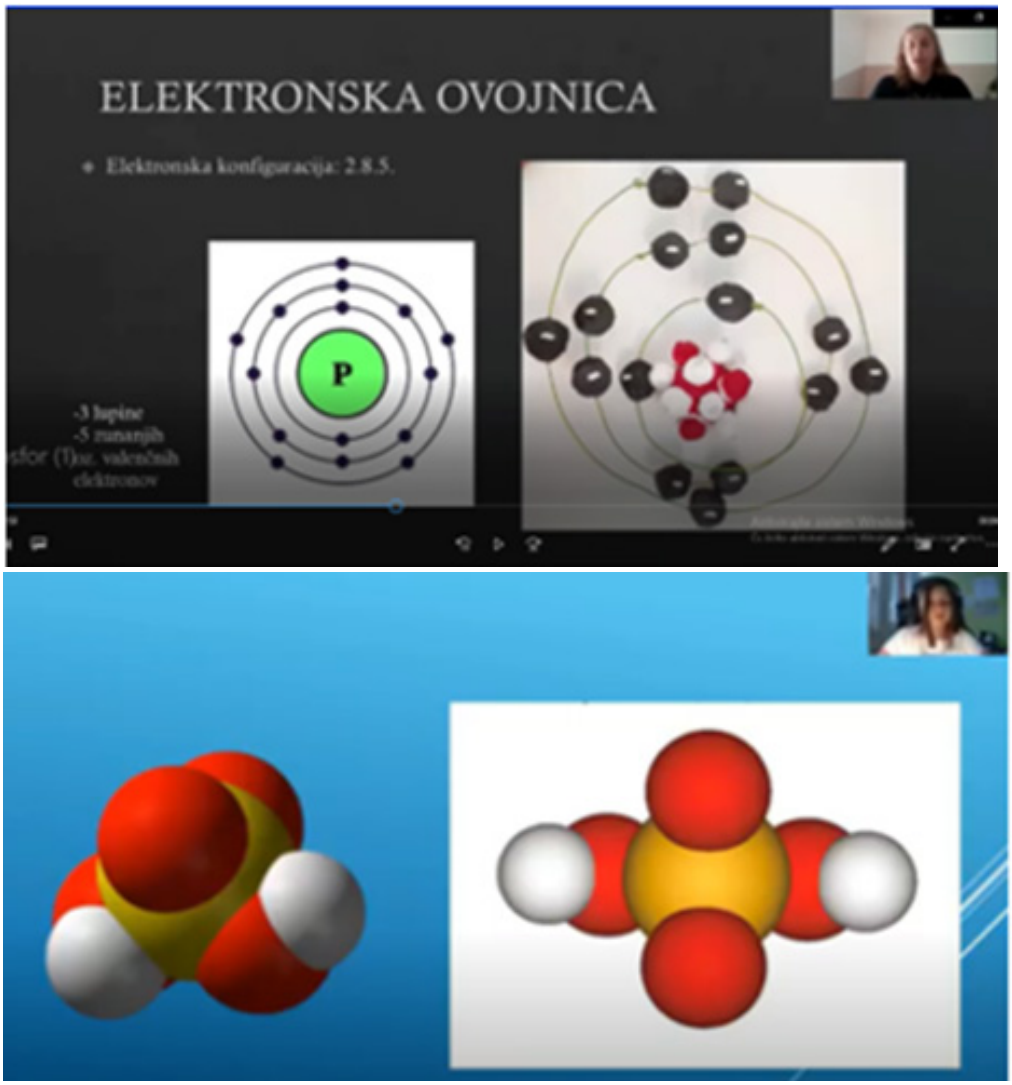
Figure 4
Students' Video Explanations on the Topic My Atom



Formative assessment emphasizes the importance of obtaining diverse evidence of learning and acquired knowledge (written, artistic, technical, practical, and other products, project work, and student performances). The diverse evidence enables students to show their knowledge in the way that suits them best. They prove what they know, how they understand the topic, and what they can do (use of knowledge, skills, problem solving, creativity). Formative assessment is how the teacher enables students to co-create the learning process (learning objectives, performance criteria, personal goals, setting questions, self-evaluation, peer assessment), which leads to a more active role of students and more sustainable knowledge.

Students assess their work and receive quality feedback from the teacher and classmates. The aim is to improve their learning and achievements (finding out to what

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extent they have achieved the goals). The videos are evidence of learning that students keep in their portfolios. The teacher does not use partial grades, pluses, minuses, and other symbols to assess the evidence of learning but exclusively gives students qualitative feedback. The relationship between the teacher and students has an important motivational effect ("Formativno spremljanje, Zavod RS za šolstvo," 2021).

Biology and English

In the new school year, lessons were conducted in the classrooms. Based on the excellent experience with the cross-curricular integration of chemistry and English, the English teacher and I decided to continue with cross-curricular integration. We decided to integrate biology and English and work with the same students as the previous school year. After thorough consideration, we chose the unit on genetics. The topic is up-to-date and engaging, but based on experience, it is quite demanding and abstract for primary school students. This topic presents a big challenge for the teacher, as well.

Due to the complexity of the content, the students first learned the subject matter and reached the set goals in biology class. They learned about genetics, genes, DNA, chromosomes, mutations, mitosis, meiosis, Gregor Mendel, inheritance, and ways of passing traits from parents to offspring. In these lessons, we used different methods and forms of work. Pupils attended live lessons and worked independently or in groups or pairs. There were many animations and video presentations, which were of great help to the students in understanding and mastering the learning objectives.

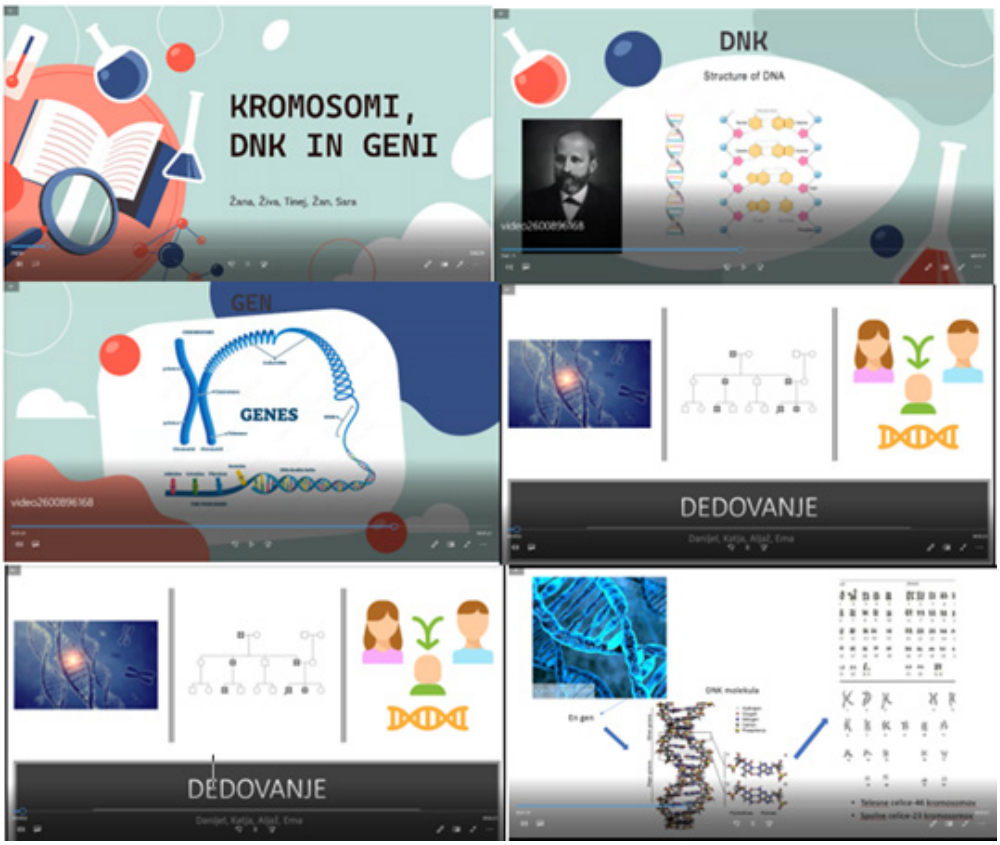
Cross-curricular integration was a part of consolidation and revision. The emphasis was on reading and listening comprehension using ICT and online applications.

The first phase took place in English class. We considered the difficulty level of English and the goals in biology. Both teachers carefully selected the text on genetics in the English language. In the Edpuzzle application, the students watched two video clips in English and did the tasks. This way, the students acquired professional terminology in English.

In biology class, students did the listening comprehension. They watched a video clip of the show Let's Bite Science: What is in Our DNA? Individually, they wrote down the terms used in biology class or read about in the English article. Then we analyzed the terms and created a word cloud. Additionally, we revised and explained the unknown terminology.

The next step was recording a video explaining genetics and inheritance in their mother tongue. The students were divided into five heterogeneous groups (the same as in the chemistry - English integration the previous year). Each group had its own content within the topic of genetics. We reviewed the instructions for making a video, prepared for chemistry class in the previous school year, and adapted them to the new situation. We also reviewed the criteria and adjusted them. Students could work freely and choose the method of presentation on their own. The two essential conditions were that each student in the group must contribute a part of the explanation and that the complexity of the content must be suitable for ninth graders.

Figure 5
Students' Video Explanations on Genetics and Inheritance



The last step before the evaluation was the assessment of their knowledge. Students assessed their knowledge by uploading video explanations to the Edpuzzle online learning tool and preparing ten questions. For homework, students from the other four groups did the tasks prepared by their classmates. In the biology lesson, we analyzed the results and assessed their work. The students provided a self-evaluation of the completed work and proposed improvements to the results (formative monitoring).

Applications

Assessment of Learning Applications according to the SAMR Model

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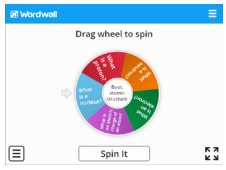
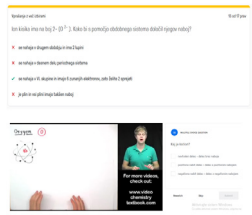
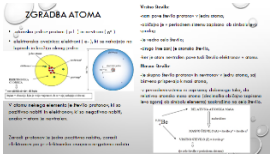
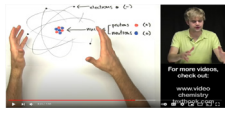
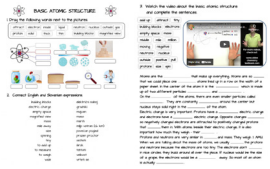
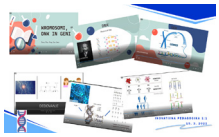
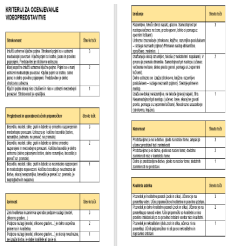
Figure 6
SAMR Model of Introducing ICT into Lessons (Jedrinović et al., 2018).

Table 1

Presentation of Applications according to the SAMR Model

SUBSTITUTION	AUGMENTATION	MODIFICATION	REDEFINITION
WordItOut	**WordWall**	**Edpuzzle**	**Wordwall**
 writing out chemistry formulas	 understanding and interpretation of acquired knowledge	 analyzing and evaluating acquired knowledge	 creating digital tasks with collaborative learning
PowerPoint	**YouTube**	**Liveworksheets**	**PPT / Zoom**
 writing down reference points and explanation of the learning material	 understanding and interpretation of acquired knowledge	 analyzing and evaluating acquired knowledge	 making video explanations
Word	**Blooket**		**Edpuzzle**
 writing down evaluation criteria	 understanding and interpretation of acquired knowledge		 making interactive tasks based on video explanation
	Microsoft Edge		
	synthesizing speech		

Note. Own work of Suzana Kotnjek and Mateja Sukič Kuzma.

https://doi.org/10.48127/gu-nse/22.19.22

Table 2
Identified Advantages and Disadvantages of the Applications Based on the Used Activities

APPLICATION	ADVANTAGES	DISADVANTAGES
YouTube	- listening comprehension, - another expert's explanation, - authentic use of the English language, - is always available to students, - the possibility of repeatedly listening and stopping the recording,	- there is no authentic teacher-student contact, - complex understanding due to a foreign language, - the teacher does not get feedback on whether the student watched the video,
Edpuzzle	- listening comprehension and visual support, - solving tasks without skipping clips, - feedback for the teacher/student, - the possibility of creating tasks, - use of own or online recordings, - creating closed classes (data protection), - partially free use,	- applications that are too demanding for some students, - technical problems, - the possibility of doing the task only once,
Wordwall	- varied and diverse templates, - suitable for all levels of teaching, - feedback for the teacher/student, - the possibility of creating tasks, - free basic version,	- limited free basic version, - feedback not available by students, only by tasks,
WordItOut	- a variety of shapes, fonts, and colors, - the possibility of writing chemistry formulas, - the possibility of using Slavic letters, - free of charge,	- instructions and use of the application are not available in Slovenian,
Liveworksheets	- digitized worksheets, - a variety of tasks, - the possibility of inserting audio/video clips, - feedback for the teacher/student, - creating workbooks, - use of already created worksheets, - the possibility of creating tasks, - the possibility of solving tasks once or multiple times,	- more demanding task creation, - the teacher must anticipate all possible correct answers,
Blooket	- fun, social and educational, - a quiz in the form of a classic computer game, - contains elements of the unexpected, - free basic version,	- limited basic version, - problems importing a ready-made list of tasks,
Microsoft Edge	- opening pdf documents, - the possibility of creating audio recordings (text to speech) in different languages, - native-speaker-like pronunciation.	- the monotony of speech.

Note. Own work of Suzana Kotnjek, Mateja Sukič Kuzma.

The Development of Digital Competences (DigComp 2.1)

Table 3

The Development of Digital Competences according to DigComp 2.1 (Carretero, Vuorikari, and Punie, 2017)

COMPETENCE AREAS	COMPETENCES	ACTIVITIES
1. Information and data literacy	1.1 Browsing, searching, and filtering data, information, and digital content	- watching an educational video on YouTube, - solving tasks in Liveworksheets, Edpuzzle, and WordItOut applications, - searching for data to create an atom model using the Google browser, - preparing a PowerPoint presentation,
	1.2 Evaluating data, information and digital content	
2. Communication and collaboration	2.1 Interacting through digital technologies	- collaborative learning in small groups using the Zoom platform and the Wordwall application, - preparation and sharing of digital content in small groups in the Wordwall application, - communication using Snapchat and Messenger groups,
	2.2 Sharing through digital technologies	
	2.4 Collaborating through digital technologies	
3. Digital content creation	3.1 Developing digital content	- creating digital content in the Wordwall application, - creating a video explanation using various tools (Zoom, PowerPoint, electronic devices), - creating digital content in the online tool Edpuzzle,
	3.2 Integrating and re-elaborating digital content	
5. Problem solving	5.1 Solving technical problems	- choosing an appropriate tool for making videos and creating digital content, - choosing an appropriate online environment for sharing digital content.

Note. Own work of Suzana Kotnjek and Mateja Sukič Kuzma.

https://doi.org/10.48127/gu-nse/22.19.22

Conclusions

Cross-curricular integration of chemistry and English took place during the lockdown, while biology and English integration took place in classrooms. All the activities presented in the paper can be combined, adjusted, and used in school, as homework, or in online classrooms. The main emphasis of the cross-curricular integration was on the use of ICT, the upgrading of chemical and biological objectives, the acquisition of professional terminology in English, and the application of acquired knowledge. Formative assessment and flipped learning are also vital parts of cross-curricular integration. Collaboration among colleagues, coordination of the work, and effective communication are essential parts of cross-curricular integration. The activities used in the cross-curricular integration should intertwine, coordinate, and be appropriate for students' abilities and prior knowledge. Above all, the teacher should be a guide and mentor.

The students' feedback was positive and encouraging. In their opinion, this way of learning is more interesting, they are active, and heterogeneous groups enable them to help each other. Students with learning difficulties also believed they could complete their tasks and performed very well in some activities.

The combined use of ICT and online applications, the use of classical teaching methods, distance work, online classrooms, and multilingualism represent an important step toward the school of the future.

Acknowledgement

The author gratefully wishes to make acknowledgement to the Project No.: C3330-17-319016; Innovative learning environment supported by ICT – Innovative pedagogy 1:1 for financial support. The project is co-financed by the Republic of Slovenia and the European Union from the European Social Fund.

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This is a revised and expanded version of the 5th International Scientific Conference on *Philosophy of Mind and Cognitive Modelling in Education* paper in *Gamtamokslinis ugdymas / Natural Science Education*. The paper was recommended for republication by the conference scientific committee. Available: https://pce-fnm.si/conference-proceedings

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Received 08 September 2022; Accepted 20 September 2022

Cite as: Kotnjek, S. (2022). Upgrading science with English and ICT. *Gamtamokslinis ugdymas / Natural Science Education, 19*(1), 22-36. https://doi.org/10.48127/gu-nse/22.19.22

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EDU-ESCAPE ROOM OR BRAIN TEASERS FOR STUDENTS IN GERMAN

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Abstract

How to make German lessons more interesting for students? How to motivate them to work more independently, to be creative and to think critically? What else is interesting for them when they use smartphones, social networks, etc. on a daily basis?
The widespread use of ICT has not only changed the daily activities and lifestyles of individuals but has also had a profound impact on education at all levels.
The joint foreign languages session of secondary school students and ninth graders had to be prepared in a way that was close to them. The COVID -19 pandemic and its associated quarantine have left many of us feeling trapped in a constant state of escape. Therefore, a virtual escape room entitled "Who Stole the Goldfish?" seemed appropriate for this workshop. Using their mobile phones, students entered a virtual world where they could communicate and collaborate without boundaries. The online escape room offered a series of clues, challenges, puzzles, and visual elements that led them to the solution - the discovery of the culprit.
The goals of the session were to promote problem solving and team building, develop group problem solving and listening skills, and build better communication skills for collaboration.
Keywords: *German lessons, use of ICT, escape room, team problem solving, communication skills*

Introduction

To give ninth graders a glimpse into the daily life of our school and make them a part of it for the next four years, we finally opened the school gates this March. We invited students to actively participate in workshops in various subject areas and become part of the pulse of the school.

The foreign language teachers teamed up to create the 'With Languages towards Treasure' workshop. The ninth graders who registered were randomly mixed with our students to form heterogeneous groups, which included students from class 1. a who study English as their first foreign language and German or French as their second foreign language. The ninth graders had the opportunity to learn all three languages or review the basics with the help of the students.

I created a single digital Escape Room format for all three foreign languages and my colleagues provided me with English and French tasks, which I then coded and integrated into the educational escape game.

In the next part of this article, I will first define the concept of an Escape Room or Edu Breakout and its key elements and present how I planned and designed the digital escape game "Who Stole the Goldfish?" and its challenges in German.

What is an Escape Room?

The Escape Room is a themed room where participants must work together as a group to find hidden objects or clues, decipher various puzzles and codes, observe well,

https://doi.org/10.48127/gu-nse/22.19.37

piece things together and come up with the final solution that will lead them to freedom within a given time (Rüter, 2020).

Escape Room in Education

Teaching and learning have changed during and since the pandemic. Flexible forms of teaching became exceedingly popular. Educational escape games, also called Breakout EDU or Edu Breakout, are a popular form of teaching as they can be used in both digital and analogue formats.

What Exactly is Behind the Term Edu Breakout and What Are Its Benefits for Teaching?

The term EduBreakout (also Breakout EDU or Learning Escape Games) is relatively new and comes from English and can be translated as *breakout* on the one hand and *edu* as an abbreviation for education on the other. It was derived from the phrase Escape Room, which was used earlier and is now mainly used in school contexts (Bollinger, 2022).

The educational escape game has many advantages: It is fun and motivates students, encourages participation, logical thinking, and creativity. Students learn social skills such as communication and teamwork, they use their strengths and help the team win.

Characteristics, Planning and Design of an Educational Escape Game

The Escape Room can be designed for different themes and all subject areas. Students work in groups to solve a variety of tasks to be completed in a given time, using different approaches.

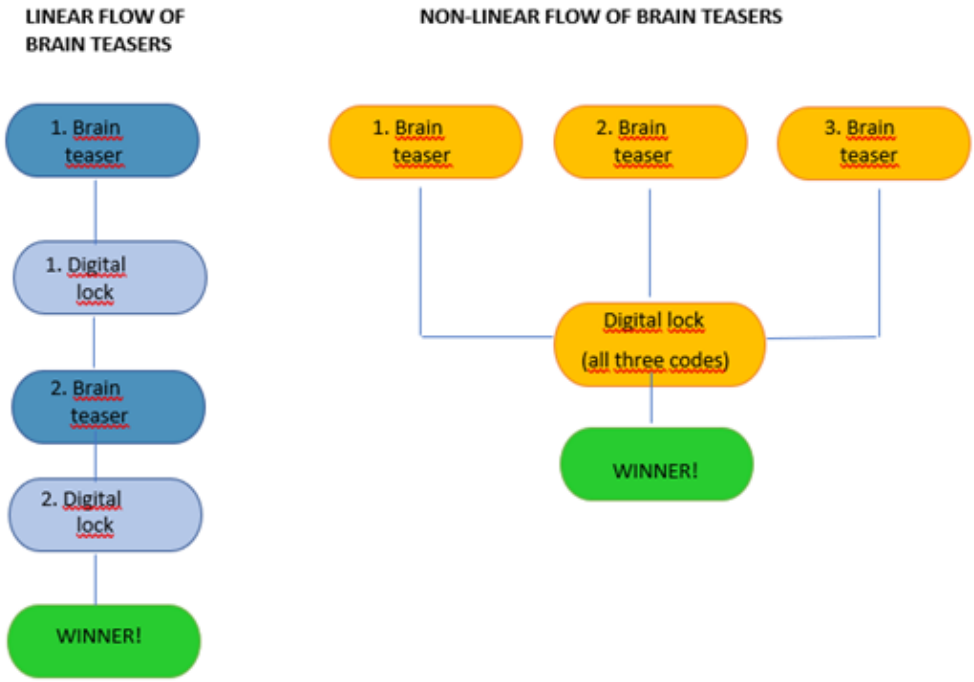
Escapes can take place on a small scale, as part of a single lesson, or on a larger scale, e.g., as an introduction to a topic, for consolidation and revision, at the beginning of the school year to meet new classmates, or as a diversion during the school year. (Lehrerweb. wien, b.d.)

Educational escape games are characterized by three elements. The basic element is a frame story that should arouse the students' interest and be as exciting as possible. This can start with an audio message, a letter, or a film.

Next, we need to think about the flow of the game - whether the sequence of mental challenges should be linear or non-linear (Figure 1). A linear progression makes sense when the tasks must follow each other in a specific order, such as when they are in chronological order or when it is necessary to review the basics before moving on to more difficult tasks. In non-linear progression, students answer the questions in any order. They see all the tasks at the beginning, but the lock can only be opened when all the answers are present. The brain teasers and tasks should be designed in such a way that the solutions are not immediately obvious and only the correct solution will lead to the code that unlocks the digital lock.

https://doi.org/10.48127/gu-nse/22.19.37

Figure 1
Course of Brain Teasers



The third element is the time limit, which can be seen as a motivational incentive for students to solve the puzzles within a certain time. It is also advisable to provide small rewards for the successful completion of the game, which is left to the teacher's discretion.

The tasks can be designed and solved in analogue or digital form. Including digital puzzles and locks in the Escape Room is a clever idea, as students are familiar with this type of task, and each of them already owns a "smartphone". The tasks to be solved are of different types, for example: logic puzzles, crosswords, math challenges, rebuses, puzzles, hidden objects in a picture, word problems, multiple choice questions... Tasks and questions where students can answer freely are not suitable.

An effective way to create an Edu Breakout is to use the Genially app. This is a web-based tool for creating Escape Rooms, interactive and animated presentations, interactive images, infographics, games, and much more. (Genially, b.d.) It can be embedded with interactive links to create a variety of digital content. The templates provided by the app are immensely helpful in this regard and can be used to design your own Edu Breakout.

To create your own content in Genially, you need to create a (free) account. Without an account, content can only be viewed, but not created.

How Did I Design the Edu-Escape Room Who Stole the Goldfish (Figure 2)?

Figure 2
Starting Page of the Edu-Escape Game

Figure 3
First Challenge in German Made in LearningApps and Der Rebus-Club

I chose the most appropriate template from those available and customized it to my needs. The animations were already there, I just needed to add the buttons for the following pages. It was also important to link the pages together - i.e., turn the navigation into a "microsite", otherwise the students would not play the game, but only look at the slides.

For the LearningApps and The Rebus Club apps (Figure 3), I created brain teasers and puzzles and assigned them a code - a word that appeared after successfully solving the task. Students had to write this code in the space provided so they could move on to the next challenge and the next win.

To get a better overview during the preparation and implementation of Edu Breakout, since I had to add English and French tasks, I created a tabular overview (Figure 4) that briefly describes the tasks and the digital locks with the correct code words. The overview also includes an introductory story.

Figure 4
A Tabular Overview of the Complete Edu-Escape Game

Task	Short description	Code	Story
1. challenge (GERMAN)	Family members: Solve the tasks and then insert the terms for family members into the text.	WANTED	Something strange is happening today. There are a lot of students on the school playground, and teachers are standing at the school gates, not letting them in. Someone said that the school was robbed last night. The headmaster tries to silence the crowd. He orders the students to go to their classrooms and wait in silence for the teachers who will explain everything to them. Someone has taken an aquarium and a goldfish from the IT room during the night. The headmaster has already called the police, who will arrive any time. Soon, the school loudspeaker is heard. The headmaster announces that the following students should report to the assembly hall ... *Your job is to find out who did it. There are 10 tasks to solve. When solving, watch out for capital and small capitals (especially in German). Once you have solved a task correctly, you will receive a key, which you can then write down in order to continue with the next task. Always write the key in capital letters and punctuation. After the 10th task, you have to form a sentence from the individual words, which is the solution (11th task) and also reveals the perpetrator.* *Lots of fun!*
2. challenge (FRENCH)	Put the teacher-student dialogue in the right order.	THE ONE,	
3. challenge (ENGLISH)	Insert verbs in the correct tense into the text.	IS	
4. challenge (GERMAN)	Insert pronouns in sentences.	WHO	
5. challenge (FRENCH)	School supplies: link pictures to concepts.	TO CHARM	
6. challenge (ENGLISH)	Search for pairs	GREGORJEVO	
7. challenge (GERMAN)	Puzzle: map of Germany	ŠPELO,	
8. challenge (FRENCH)	Complete the text with the missing words from the list of words heard in the song.	IS	
9. challenge (ENGLISH)	Fruit and vegetables: search for pairs	FOR	
10. challenge (common)	Find one term (= the cause of the plot in the story) in all three languages	MARKO.	
11. challenge (common)	A card from which the coating must be removed to display the complete sentence from the individual codes. (THEY HAVE TO FIGURE OUT THE PROCEDURE THEMSELVES)	THE ONE WHO IS FOR GREGORJEVO WANTED TO CHARM ŠPELA IS MARKO.	

https://doi.org/10.48127/gu-nse/22.19.37

Summing-up

This was the first escape game I created. I have made three more so far, and the will to make more has not left me yet.

Learning material taught in this way makes lessons incredibly exciting and interesting, students are rewarded for their efforts with fun and enjoyment.

The benefits I have experienced as a teacher are: the escape game increases student motivation and interest in the subject, it encourages collaboration and communication, i.e., social interactions between students, and it is suitable for any group of students - regardless of age or subject area.

Planning and designing an Edu-Escape game and putting together the individual challenges takes a lot of time and effort. How interesting and entertaining the game is depends on the designer. It also demands certain technical requirements. The hardware and the Internet must be equally accessible to all students, because they are not equally good at using technology.

Even if the disadvantages do not outweigh the advantages, but are still a hindrance, your students will be grateful for your efforts!

Acknowledgement

The author gratefully wish to make acknowledgement to the Project No.: C3330-17-319016; Innovative learning environment supported by ICT – Innovative pedagogy 1:1 for financial support. The project is co-financed by the Republic of Slovenia and the European Union from the European Social Fund.

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Received 05 September 2022; Accepted 25 September 2022

Cite as: Tusun, S. (2022). EDU-ESCAPE room or brain teasers for students in German. *Gamtamokslinis ugdymas / Natural Science Education, 19*(1), 37-41. https://doi.org/10.48127/gu-nse/22.19.37

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EARLY COMPUTER SCIENCE LEARNING WITHOUT A COMPUTER

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Abstract

This work presents the activities of a teacher that creates and leads an educational process, which is co-created by students, according to their abilities. The aim of such learning process is early computer science and computational thinking education. The theoretical part explains problem-oriented teaching, computational thinking and why it should be developed already in the lower grades of primary school. Then the teaching activities are presented that enable students to learn computer science without devices. Problem oriented activities are based on a created stimulating learning environment with emphasis on critical thinking and creativity development. The activities were prepared in such a way that students of this age are familiar with the elements used.
Key words: *computational thinking education, early computer science education, problem-oriented education*

Introduction

Nowadays, teachers have a lot of freedom in planning and implementing the learning process. This enables us to carry out the learning process in different ways. What is the biggest challenge for a teacher? Heacox (2015) explains that for a lot of individuals it is the need to adapt to more various needs of students, learning methods and various social backgrounds of students.

It can happen that the way to the goal is more important than the goal itself. Some ways prove better than others. In modern times, we know that next to reading, writing and calculating, students need knowledge about how to use a computer, since life gives us new challenges every day. Thus, it's important to develop such a way of learning that provides the opportunities to develop strategies which will aid an individual to act alone in these changing social circumstances. "Such a person has to obtain knowledge that is needed for further education and function in the society." (Krek, 2022, p. 114).

"The focus of education has to be on the learners, on their experience, on their independent, conscious searching for new discoveries so they can activate their exploring processes, methodological and methodical experiences."

A problem-oriented learning innovation, thus problem solving, is a suitable approach for such purposes. Why? Because during such learning and teaching process, students actively face problems in form of learning content, enrich their experience, search independently for solutions, and get acquainted with solving methods and processes." (Strmčnik, 1992, p. 5).

"Only by independent solving of problems, basic characteristics of creative thinking and handling, for instance, divergency and critical thinking, can be developed and the same applies to innovation, the desire for new know-how, knowledge transfer and abilities to adapt to new situations, combining previous and new experiences, development of alternative solutions and processes etc." (Strmčnik, 1992, p. 6).

https://doi.org/10.48127/gu-nse/22.19.42

What is Learning with Technology and How Does It Work?

"Learning with technology are learning situations, in which we create the learning experience with the help of physical devices, such as computers and the Internet. Every learning process involves to some extent technology." (Dumont et al., 2013, p. 167).

"By learning with technology, we have a model of information processing. The information processing system consists of three ways of memorizing:

- Perceptual memory: can keep all incoming visual information in visual form and all incoming sounds in auditive form for a short time.
- Working memory: can keep a limited number of chosen words and pictures for further processing.
- Long-term memory: unlimited data storage.

Visual material and printed words step into the cognitive system of students through their eyes and stay for a short amount of time in the visual perceptual memory, while spoken words enter through the ears and stay for a limited time in the auditive perceptual memory. If the students are focused on the entering visual material, some of it can be transformed into working memory for further processing. If the students are focused on the entering auditive material, some of it can be transformed into working memory for further processing." (Dumont et al., 2013, p. 169).

Computational Thinking

The authors Kranjc et al. (2017) state in Education that some think of computational thinking as one of the key skills of students in the 21st century. Although computational thinking is understood as cognitive science that is closely connected to computational coding, coding is by far not the only activity that demands the utilization of computational thinking processes.

Computational thinking should therefore mean a way of thinking that can be an important tool for creative as well as critical thinking, decision making and problem solving. It assumes development of open problem solutions in a way that follows a series of well-defined steps. Students who cannot develop abilities of computational thinking are limited in their problem- solving skills. Furthermore, research shows that problem-solving skills are one of the most important predictors for learning and later working success.

The method of problems facing as it is presumed by computational thinking, is the key approach in problem solving for all professional areas. Computer science is no longer only a new and important view of world understanding but also an important aspect of all areas.

Kranjc et al. (2017) state that an individual cannot develop computational thinking to the full extent if such a person does not understand the basic principles of computer science and information technology. Thus, it is important for a student to systematically obtain the necessary knowledge on computational thinking in a guided and clear focused learning and teaching process.

The Project Day

While considering if first graders are able of computational thinking development, I was reading various literature and noticed that it isn't mandatory for students to have an actual computer in front of them.

As a class teacher, I asked an extended day care teacher for assistance. We organized a project day for the first graders. We prepared a stimulating learning environment for critical thinking development, creativity stimulation, and problem-oriented activities. Those were designed in such a way that students at that age were familiar with them (alphabet letters, counting to nine, moving by instructions). All presented activities are described in a master degree thesis (Ropret, 2019). We included cross-curricular content from mathematics, physical education, and art into the subject specific learning plans for Slovene language.

We kicked off the day with an activity where each student created their own robot from various materials. Such a robot came into action during other activities that followed.

The next activity, we called Alphabet. On the floor, we already created a square mesh. Each field contained one letter of the Slovenian alphabet. We discussed the starting field with the students. For moving along the net, we used the instructions step forward, step backward, step to the left, step to the right and squat. The command squat meant that the chosen student came to the designated letter by the person that spoke the commands.

After a few repetitions, we upgraded the activity by having the student who executed the commands "write out" the name of the one who dictated the commands. The next upgrade was in giving commands in a shorter form, as the students realized that if a command is repeated several times, they can say, for example, take four steps forward.

To make the activity more dynamic, we prepared another two meshes and divided students into groups that used the same commands, moved along the numbers, or simply had to reach their robot that we built in the beginning.

We didn't achieve the symbolic record, since our next step was the activity "If … else". Students gathered in a circle. The teacher read a statement. If the statement were to be true for a student, he or she had to carry it out, otherwise they didn't have to do anything. Students understood the statements beginning with "if", they had more troubles with the command "else", since they didn't understand the meaning of all statements.

In the final part of the day, students learned about following instructions and a sequence of commands. The teacher jumped into the role of Simon and in case of the phrase "Simon says" at the beginning of the command, students carried out the command, otherwise they didn't have to.

Conclusions and Implications

All carried out activities included in a didactical approach that leads a six-year-old through a game and brings him to understanding of basic computational thinking concepts with a significant range of own activity. Students developed listening comprehension and speaking skills, learned about the meaning of giving and understanding clear instructions, with their own engagement they obtained the knowledge, how important it is to give exact instructions and that there can be more than one method to reach the right solution.

It was observed that students started to connect and to merge expressions from basic to advanced level themselves. For instance, they united a sequence of same expressions into

 https://doi.org/10.48127/gu-nse/22.19.42

a group of commands and built some kind of subsequences. Students stepped within the DigComp 2.1 framework with recognizing of basic terms from logical and computational thinking (basic moving commands) to the level of foundation and discovered problems, tried to solve them, they were creative, got acquainted with coding without devices through games (gamification), developed solving strategies, learnt in a collaborative way and with teamwork. Within the groups, they took over the initiative and guided their fellow peers. They were active participants in preparing and designing the learning environment.

While offering new and different ways of obtaining knowledge, ways that didn't limit students in their work, the competences of teachers were expressed. Among them, the entrepreneurship competence "from idea to product" was visible, also vision, self-awareness, and self-efficiency, mastering of uncertainty, doubt, and risk. The above-described activity and method of learning proved as efficient, increased the students' motivation as well as their active involvement in school activities, since it stimulated them to own engagement and ideas, therefore I will give more focus to such methods and develop it further in the future.

Acknowledgement

The author gratefully wish to make acknowledgement to the Project No.: C3330-17-319016; Innovative learning environment supported by ICT – Innovative pedagogy 1:1 for financial support. The project is co-financed by the Republic of Slovenia and the European Union from the European Social Fund.

Note

This is a revised and expanded version of the 5th International Scientific Conference on *Philosophy of Mind and Cognitive Modelling in Education* paper in *Gamtamokslinis ugdymas / Natural Science Education*. The paper was recommended for republication by the conference scientific committee. Available: https://pce-fnm.si/conference-proceedings

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Received 08 September 2022; Accepted 28 September 2022

Cite as: Weis, K. (2022). Early computer science learning without a computer. *Gamtamokslinis ugdymas / Natural Science Education, 19*(1), 42-46. https://doi.org/10.48127/gu-nse/22.19.42

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DEVELOPING BRIDGING COURSES FOR MATHEMATICS AND SCIENCE TEACHER STUDENTS

ERASMUS+ Programme Key Action 2 Strategic Partnership for higher education

https://www.bridge2teach-project.eu

PROJECT AIM

The main aim of the project is to develop, test, revise, finalise and disseminate materials for a bridging course for mathematics teacher students and a bridging course for science teacher students, and provide workshops for teacher trainers and for university staff who deliver bridging courses to mathematics and science students, demonstrating and working on how they can use these materials in their own mathematics and science teacher training bridging courses.

TANGIBLE RESULTS

- reports on status quo of local/regional math/science teacher training bridging courses,
- guidelines for developing bridging courses for mathematics and science teacher students,
- an evaluation form for bridging courses,
- curricula and teaching materials for bridging courses for mathematics teacher students and for science teacher students,
- a report about process and results of bridging course evaluation,
- a final conference,
- a project website.

BRIDGING COURSE STRUCTURE

Science BC

Module 1 – Physics
- Nature research – general concepts and laws
- Natural sciences about the micro-, macro- and mega- world
- 21st century physics, quantum physics essence
- Introduction to natural science practical work
- Self-test

Module 2 – Chemistry
- Laboratory guide
- The periodic table of elements
- Chemical reactions
- Appendix
- Self-test

Module 3 – Biology
- Cells
- Simple organisms: viruses and bacteria
- The chemicals of life
- Transmission of nerve impulses
- Self-test

Mathematics BC

Module 1 – Introduction and overview
- A brief general introduction into mathematics.
- An overview of the various fields of mathematics.

Module 2 – Basic concepts
- Logic and sets
- Geometry
- Vectors
- Linear and quadratic equations
- Introduction to functions

Module 3 – Functions
- Linear and quadratic functions
- Exponential and logarithmic functions
- Trigonometric functions

Module 4 – Tools for real life
- Probability
- Statistics
- Limits, derivatives and integrals

PROJECT TEAM & ACTIVITIES

PROJECT PARTNERS

University of Vienna, Austria
Palacky University Olomouc, Czech Republic
University of Palermo, Italy
Constantine the Philosopher University, Slovakia
Vilnius University Šiauliai Academy, Lithuania

Project number: 2019-1-AT01-KA203-051222

Co-funded by the Erasmus+ Programme of the European Union

The project is carried out with the support of the European Community in the framework of the ERASMUS+, Call 2019 Round 1 KA2 - Cooperation for innovation and the exchange of good practices KA203 - Strategic Partnerships for higher education.

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ISSN 1648-939X /Print/, ISSN 2669-1140 /Online/

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GAMTAMOKSLINIS UGDYMAS / NATURAL SCIENCE EDUCATION
ISSN 1648-939X /Print/, ISSN 2669-1140 /Online/

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GAMTAMOKSLINIS UGDYMAS
2022, Vol. 19, No. 1

Sudarė Vincentas Lamanauskas (vyriaus. red.)
Redaktorė Loreta Šimutytė-Balčiūnienė
Dailininkė Jurgina Jankauskienė
Anglų kalbos korektorė Ilona Ratkevičienė

2022-10-15. 3,125 leidyb. apsk. l. Tiražas 80 egz.

Išleido MMC „Scientia Educologica“ ir Scientia Socialis
Donelaičio g. 29, LT-78115 Šiauliai
El. paštas gu@gu.puslapiai.lt

Spausdino UAB Šiaulių spaustuvė
P. Lukšio g. 9a, Šiauliai
El. paštas info@dailu.lt, tel. / faksas (8 41) 500 333
Interneto adresas http: / /www.dailu.lt

NATURAL SCIENCE EDUCATION
2022, Vol. 19, No. 1

Compiler Vincentas Lamanauskas (Editor-in-Chief)
Language Editor Loreta Šimutytė-Balčiūnienė
Designer Jurgina Jankauskienė
English language proofreader Ilona Ratkevičienė

15 October 2022. 3,125 printer`s sheets. Edition 80.

Publisher SMC „Scientia Educologica“ in cooperation with Scientia Socialis
Donelaičio Street 29, Šiauliai, Lithuania
E-mail: gu@gu.puslapiai.lt

Printing Šiauliai printing house
9a Lukšio Street, LT-76207 Šiauliai
E-mail: info@dailu.lt, phone / fax +370 41 500 333
http: / /www.dailu.lt

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